

AMENDMENTS TO THE CLAIMS

Please **CANCEL** claims 5-6 without prejudice or disclaimer.

Please **AMEND** claims 1, 4, 7, 9, and 11-12 as shown below.

The following is a complete list of all claims in this application.

1. (Currently Amended) A light scattering type smoke sensor comprising:

a sensor body;

a light-emitting opening and a light-receiving opening that are disposed on an outer surface of the sensor body;

a transparent cover that is attached to the outer surface of the sensor body for covering the light-emitting opening and the light-receiving opening;

~~a light-emitter that is incorporated in the sensor body to emit light toward an open smoke-sensing space located outside the sensor body;~~

~~a light-receiver that is incorporated in the sensor body to receive scattered light generated by the light emitted from the light emitter to the smoke-sensing space, and to output a light received signal corresponding to an amount of received light scattered;~~
and

~~a fire judging unit that is incorporated in the sensor body judges presence/absence of fire occurrence based on the amount of received light identified by the light received signal output from the light receiver, wherein:~~

the light-emitter is configured for emitting light toward a smoke-sensing point that

is set in an open smoke-sensing space located outside the transparent cover via the light-emitting opening;

the light-receiver is configured for receiving scattered light generated by the light emitted from the light-emitter to the smoke-sensing point via the light-receiving opening, and to output a light-received signal corresponding to an amount of received light scattered; and

the fire judging unit is configured for judging presence/absence of fire occurrence based on the amount of received light identified by the light-received signal output from the light-receiver.

2. (Original) The light scattering type smoke sensor according to claim 1, wherein the fire judging unit judges the present/absence of the fire occurrence based on the amount of received light and a differential value of the amount of received light.

3. (Original) The light scattering type smoke sensor according to claim 2, wherein the fire judging unit judges that fire occurs when the amount of received light exceeds a predetermined fire threshold and the differential value of the amount of received light is equal to or lower than a predetermined false alarm threshold.

4. (Currently Amended) The A light scattering type smoke sensor according to claim 3, wherein comprising:

a sensor body;

a light-emitter that is incorporated in the sensor body to emit light toward an open

smoke-sensing space located outside the sensor body;

a light-receiver that is incorporated in the sensor body to receive scattered light generated by the light emitted from the light-emitter to the smoke-sensing space, and to output a light-received signal corresponding to an amount of received light scattered;
and

a fire judging unit that judges presence/absence of fire occurrence based on the amount of received light identified by the light-received signal output from the light-receiver; wherein:

the fire judging unit judges the present/absence of the fire occurrence based on the amount of received light and a differential value of the amount of received light;

the fire judging unit judges that fire occurs when the amount of received light exceeds a predetermined fire threshold and the differential value of the amount of received light is equal to or lower than a predetermined false alarm threshold; and

when the amount of received light exceeds the predetermined fire threshold, and the differential value of the amount of received light exceeds the predetermined false alarm threshold, the fire judging unit checks whether the amount of received light exceeds a predetermined obstacle threshold or not when a predetermined time elapses since the time the differential value exceeds the predetermined false alarm threshold, and judges that there is an obstacle for fire sensing when the amount of received light exceeds the obstacle threshold.

5-6. (Cancelled)

7. (Currently Amended) ~~The~~ A light scattering type smoke sensor according to claim 6, wherein comprising:

a sensor body;

a light-emitter that is incorporated in the sensor body to emit light toward an open smoke-sensing space located outside the sensor body;

a light-receiver that is incorporated in the sensor body to receive scattered light generated by the light emitted from the light-emitter to the smoke-sensing space, and to output a light-received signal corresponding to an amount of received light scattered;
and

a fire judging unit that judges presence/absence of fire occurrence based on the amount of received light identified by the light-received signal output from the light-receiver, wherein:

the light-emitter comprises a first light-emitter that emits light of a first wavelength, and a second light-emitter that emits light of a second wavelength which is shorter than the first wavelength; and

a first scattering angle formed by mutual crossing of a light axis of the first light-emitter and a light axis of the light-receiving element is smaller than a second scattering angle formed by mutual crossing of a light axis of the second light-emitter and the light axis of the light-receiving element.

8. (Previously Presented) The light scattering type smoke sensor according to claim 7, wherein:

a central wavelength of the first wavelength is equal to or longer than 800 nm;

a central wavelength of the second wavelength is equal to or shorter than 500 nm;

the first scattering angle falls within a range of approximately 20° to 50°; and

the second scattering angle falls within a range of approximately 100° to 150°.

9. (Currently Amended) ~~The~~ A light scattering type smoke sensor according to claim 6, wherein comprising:

a sensor body;

a light-emitter that is incorporated in the sensor body to emit light toward an open smoke-sensing space located outside the sensor body;

a light-receiver that is incorporated in the sensor body to receive scattered light generated by the light emitted from the light-emitter to the smoke-sensing space, and to output a light-received signal corresponding to an amount of received light scattered;
and

a fire judging unit that judges presence/absence of fire occurrence based on the amount of received light identified by the light-received signal output from the light-receiver, wherein:

the light-emitter comprises a first light-emitter and a second light-emitter;

the first light-emitter emits light having a polarization plane vertical to a first scattering plane that passes through a light axis of the first light-emitter and a light axis of the light-receiving element;

the second light-emitter emits light having a polarization plane parallel to a second scattering plane that passes through a light axis of the second light-emitter and

the light axis of the light-receiving element; and

a first scattering angle formed by mutual crossing of the light axis of the first light-emitter and the light axis of the light-receiving element is smaller than a second scattering angle formed by mutual crossing of the light axis of the second light-emitter and the light axis of the light-receiving element.

10. (Previously Presented) The light scattering type smoke sensor according to claim 9, wherein:

the first scattering angle is equal to or smaller than 80° ; and

the second scattering angle is equal to or larger than 100° .

11. (Currently Amended) The light scattering type smoke sensor according to claim 6 7, wherein the plural light-emitters are arranged at solid angles, so that planes including respective light axes of the plural light-emitters and the light axis of the light-receiving element are substantially not identical with each other.

12. (Currently Amended) The light scattering type smoke sensor according to claim 6 7, wherein:

~~the light emitter includes a first light emitter and a second light emitter; and~~

the fire judging unit compares an amount of received light by the light-receiver with respect to scattered light generated from the light emitted by the first light-emitter and scattered by smoke with an amount of received light by the light-receiver with respect to scattered light generated from the light emitted by the second light-emitter

and scattered by the smoke, ~~to identify a type of the smoke,~~ identifies a type of the smoke based on the comparison result, and judges the presence/absence of fire occurrence based on a standard corresponding to the type of the smoke.

13. (Previously Presented) The light scattering type smoke sensor according to claim 1, wherein a mutual crossing point of the light axis of the light-emitter and the light axis of the light-receiver in the smoke-sensing space is at least approximately 5 mm away from the sensor body.

14. (Previously Presented) The light scattering type smoke sensor according to claim 1, wherein at least one portion of an outer surface of the sensor body is configured by an insect avoiding material, or an insect avoiding agent is applied or made to permeate to at least one portion of the outer surface of the sensor body.

15. (Previously Presented) The light scattering type smoke sensor according to claim 1, wherein the light-receiver has an angle of field of view not larger than 5 degrees.

16. (Previously Presented) The light scattering type smoke sensor according to claim 1, wherein the light-emitter emits collimated parallel beam.

17. (Previously Presented) The light scattering type smoke sensor according to claim 1, further comprising a logarithmic amplifier which amplifies the light-received

signal output from the light-receiver.

18. (Previously Presented) The light scattering type smoke sensor according to claim 1, further comprising:

a light emission controller that drives the light-emitter to intermittently emit light by using a modulated light-emission signal; and

an amplifier that amplifies the light-received signal output from the light-receiver in synchronization with the modulated light-emission signal.

19. (Previously Presented) The light scattering type smoke sensor according to claim 18, further comprising a light emission controller that drives the light-emitter to intermittently emit light by using a modulated light-emission signal, wherein:

the light-emitter emits light within a visible light wavelength band; and

the light emission controller drives to intermittently emit light at a light-emission pulse width of equal to or smaller than 1 millisecond.

20. (Previously Presented) The light scattering type smoke sensor according to claim 19, wherein the light emission controller sets a total light emission time period in an intermittent light emission equal to or smaller than 1 millisecond.